Upper Lower Miocene Aggradational Play
LM4 A1, #2341
Marginulina ascensionensis and *Discorbis bolivarensis*

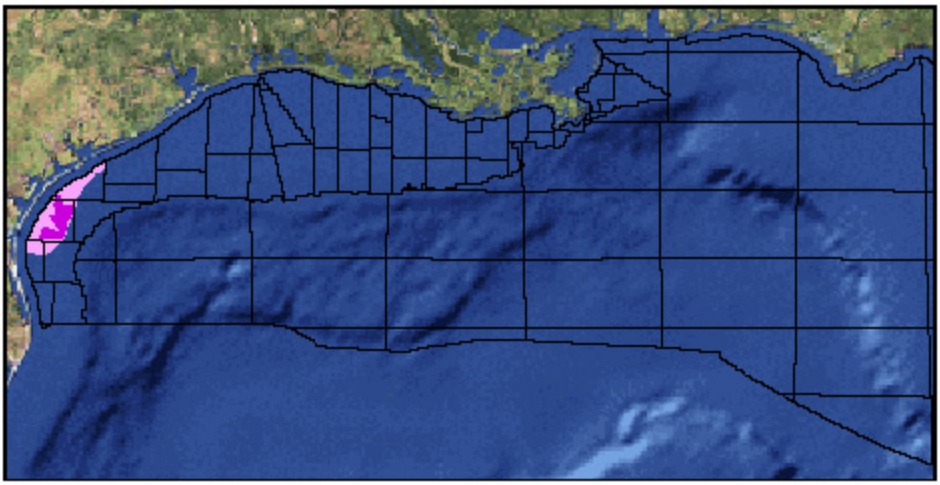

Figure 315. LM4 A1 map showing location of play. Play limit shown in light magenta; hydrocarbon limit shown in dark magenta.

Overview

The Upper Lower Miocene Aggradational Play (LM4 A1) contains reserves of 345.286 Bcfg and 1.032 MMbo (62.471 MMBOE) in 41 sands in 13 fields. The play extends continuously across the modern GOM shelf from the North Padre Island to Matagorda Island Area (Figure 315).

Description

LM4 A1 is defined by (1) an aggradational depositional style representing sediment buildup in continental to shallow marine shelf environments and (2) the LM-3 and LM-4 Chronozones, the tops of which are defined by the *Marginulina ascensionensis* and *Discorbis bolivarensis* biozones, respectively (Figure 8).

LM4 A1 extends continuously across the modern GOM shelf from the North Padre Island to Matagorda Island Area offshore Texas (Figure 315). Hydrocarbons have been encountered mostly in the Mustang Island Area.

Depositional systems included the North Padre Delta System in the southern Texas area and the Calcasieu Delta System along the Texas-Louisiana border (Galloway et al., 1986). The LM4 Chronozone marks the first occurrence of aggradational sediments in the Federal OCS as the Texas delta had prograded farther basinward than in either lower lower Miocene (LM1) or LM2 time. LM4 also marks the first occurrence of retrogradational facies in the Federal OCS.

Play Limits

Updip and along strike, LM4 A1 extends onshore into Texas. Downdip, LM4 A1 deposits grade into the sediments of the Upper Lower Miocene Progradational Play (LM4 P1).

Depositional Style

Aggradational sediments that formed as delta-plain and delta-front sands characterize LM4 A1 depositionally, and include channel/levee complexes, crevasse splays, distributary mouth bars, shelf blanket sands, and delta-fringe sands. These sands are often coarse-grained and exhibit a blocky

log signature. LM4 A1 comprises a significant portion of the LM4 section in terms of net sand development, reaching a thickness of approximately 1,500 ft. Many of the aggradational sands do not contain hydrocarbons because of the lack of sealing shales.

Structural Style

The majority of fields in LM4 A1 are structurally associated with anticlines, normal faults, and growth faults with rollover anticlines. Less commonly, shale diapirs with traps on the flanks of the diapir or in sediment drape over the diapir occur.

Quantitative Attributes

On the basis of reserves calculations, LM4 A1 contains 98% gas and 2% oil (condensate). The 41 sands in the play comprise 50 reservoirs, all of which are nonassociated gas. All reserves are proved and estimated to be 345.286 Bcfg and 1.032 MMbo (62.471 MMBOE) (Table 151). These reserves account for only 9% of the reserves for the LM4 Chronozone.

	No. of Sands	Oil (MMbbl)	Gas (Bcf)	BOE (MMbbl)
Proved	41	1.032	345.286	62.471
Cum. production	41	0.525	196.003	35.401
Remaining proved	22	0.508	149.283	27.070
Unproved	0	0.000	0.000	0.000

Table 151. LM4 A1 reserves and cumulative production.

Cumulative production from LM4 A1 totals 196.003 Bcfg and 0.525 MMbo (35.401 MMBOE) from the 41 sands in the play. This production accounts for less than 7% of the LM4 Chronozone's total production. Remaining proved reserves in the play are 149.283 Bcfg and 0.508 MMbo (27.070 MMBOE) in 22 sands in nine fields.

41 Sands	Min	Mean	Max
Water depth (ft)	78	146	212
Subsea depth (ft)	5,975	8,321	12,140
Reservoirs per sand	1	1	4
Porosity	17%	26%	33%
Water saturation	16%	33%	59%

Table 152. LM4 A1 sand attributes. Values are volume-weighted averages of individual reservoir attributes.

Table 152 summarizes that water depths of the fields in LM4 A1 range from 78-212 ft, and play interval discovery depths vary from 5,975-12,140 ft, subsea. Additionally, porosity and water saturation range from 17-33% and 16-59%, respectively.

Exploration History

LM4 A1 has a 22-year history of discoveries (Figure 316). The first sand in the play was discovered in 1977 in the Mustang Island 757 Field. The maximum number of sands discovered in any year occurred in 1993 with 10 sands from five fields. However, the maximum yearly reserves of 26.836 MMBOE were added in 1982 with the discovery of 4 sands from one field. Early discoveries in the play, from 1977 to 1984, account for over 75% of the play's reserves and include the 6 largest sands in LM4 A1.

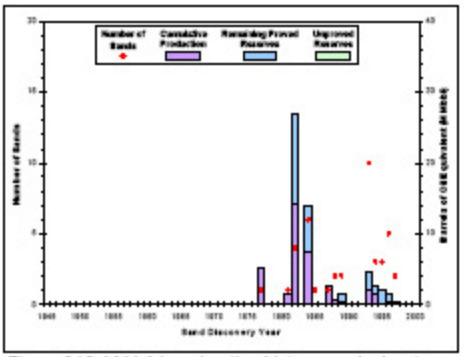

Figure 316. LM4 A1 exploration history graph showing reserves and number of sands discovered by year.

The largest sand in the play was discovered in 1982 in the Mustang Island A31 Field and contains an estimated 14.305 MMBOE (Figure 317). The mean sand size for the play is 1.524 MMBOE. Since the first Atlas database cutoff of January 1, 1995, 10 sands have been discovered, the largest of which is estimated to contain 1.247 MMBOE.

Production History

LM4 A1 has a 17-year history of production (Figure 318). Production from the play began in 1982. Oil (condensate) and gas production curves are very similar, decreasing fairly steadily until 1989, when production increased sharply as a number of the largest sands in the play reached their maximum production levels. Production peaked in the early 1990's. Production has since declined steadily.

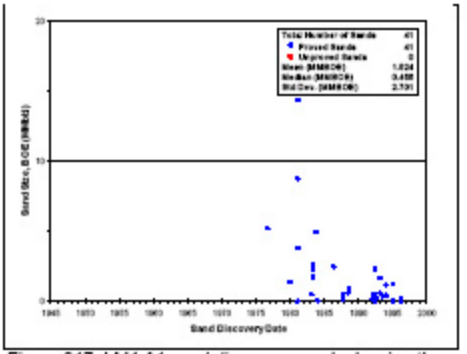

Figure 317. LM4 A1 sand discovery graph showing the size of sands discovered by year.

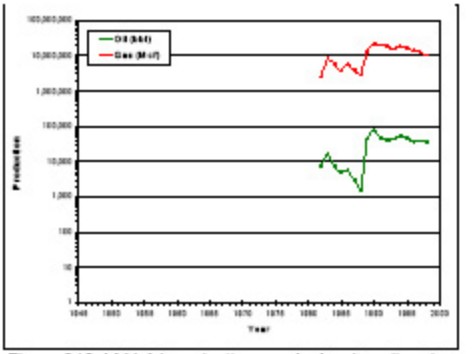

Figure 318. LM4 A1 production graph showing oil and gas production by year.